

ECE 345: Introduction to Control Systems / ME 380: Analysis and Design of Mechanical Control Systems

Syllabus

Professor Oishi

August 17, 2020

1 Course and Instructor Information

Instructor: Dr. Meeko Oishi, ECE 134C (oishi@unm.edu)

Student drop-in hours: Tuesday 11am-1pm, and by appointment; Zoom link in UNM Learn

TA: Mr. Connor Halsey, TBD (chalsey@unm.edu)

Student drop-in hours: Wednesday 9am-10am (tentative); Zoom link in UNM Learn

Course Location and Time: Online synchronous session: Tuesday and Thursday, 3:30pm-4:45pm; Zoom link in UNM Learn

Prerequisites: ECE students: ECE 314. ME students: Math 316 and ME 357.

1.1 Course Description

ECE 345: Introduction to the feedback control problem. Plant modeling, transfer function and state-space descriptions. Stability criteria. Nyquist and root-locus design. Introduction to analytical design. Z-transforms and digital control. Laboratory design project.

ME 380: System dynamics and modeling; transfer functions; concept of feedback and system stability; transient and steady-state response; control system analysis and design using root locus and frequency response methods. Prerequisites: 357 and MATH 316. Restriction: ME majors, senior standing.

1.2 Course Materials

Textbook (Recommended): N. Nise, *Control Systems Engineering*, 8th edition, John Wiley & Sons, 2019. The 8th version is available as an e-textbook through the Inclusive Access program at the UNM Bookstore, and is accessible through Learn via RedShelf. **Please note that this is an opt-out program; if you choose not to purchase the e-textbook, you must opt-out before September 4, 2020.**

Instructional technology: This is a remote synchronous course. Students will access and submit course materials through UNM Learn.

Students will need to use Matlab throughout the course, and in particular, in problem sets. Matlab is available to all students for free through UNM IT, at <http://it.unm.edu/download/>.

1.3 Grading

The final grade will be computed via the following weighting.

- 20% Final
- 20% Midterms (10% each)
- 20% Collaborative quizzes (best 4 out of 5)
- 20% Problem sets (best 4 out of 5)
- 20% Participation

Grade assignment will follow standard fractionated letter grades: $A^+ = 97 - 100$, $A = 94 - 96$, $A^- = 90 - 93$, $B^+ = 87 - 89$, $B = 84 - 86$, $B^- = 80 - 83$, $C^+ = 77 - 79$, $C = 74 - 76$, $C^- = 70 - 73$, $D = 60 - 69$, $F = 0 - 59$.

The participation grade covers a variety of student activities:

- Discussion questions (5%): Before some synchronous sessions, discussion questions will be posed in Microsoft Teams. Students will receive points for completing polls and responding to open-ended questions, as appropriate.
- Course feedback (5%): Students will receive points for completing informal and UNM requested course feedback forms.
- Asynchronous quizzes (10%): Students will receive points for completing the asynchronous quizzes after each required video.

2 Topics Covered

2.1 Course Content and Calendar

Week 1	Module 1: Introduction		
Week 2	Module 2: Transfer functions	Collaborative quiz #0	August 27
Week 3	Modules 2 & 3: Transfer functions	Problem set #1	September 3
Week 4	Module 3: State-space models	Collaborative quiz #1	September 10
Week 5	Module 4: Transient response	Problem set #2	September 17
Week 6	Module 4: Transient response	Collaborative quiz #2	September 24
Week 7	Module 5: System reduction	Midterm #1	October 1
Week 8	Module 5: System reduction		
Week 9	Module 6: Stability	Collaborative quiz #3	October 15
Week 10	Module 6: Stability	Problem set #3	October 22
Week 11	Module 7: Steady-state error	Collaborative quiz # 4	October 29
Week 12	Module 7: Steady-state error	Problem set #4	November 5
Week 13	Module 8: Root locus method	Midterm #2	November 12
Week 14	Module 8: Root locus method		
Week 15	Module 9: Frequency response methods	Problem set #5	November 24 (Tues)
Week 16	Module 9: Frequency response methods	Collaborative quiz #5	December 1 (Tues)

No class will be held November 3 and November 26. The last day of class is December 4. The final exam will occur sometime December 7–12. The semester starts August 17.

3 Weekly Schedule

The course will involve both synchronous and asynchronous activities.

Asynchronous activities: The purpose of the asynchronous quizzes is to help you learn and remember the concepts presented in the textbook, videos, and lecture notes. Unlike many quizzes and tests you’ve encountered before, these are intended as learning activities in and of themselves. Research shows that quizzing is a particularly effective way to learn information quickly. These quizzes are set up to encourage you to test yourself early and often.

Students should complete the videos and quizzes associated with each module on their own. A detailed summary is provided at the start of each module. Each module consists of a sequence of approximately 7–10 video lectures; successful completion of a quiz after each video is required before the next video is enabled for viewing. Some videos and quizzes will need to be completed prior to synchronous sessions; in this case, the specific videos and quizzes required will be enunciated in the Module Overview.

Synchronous activities: Collaborative quizzes will occur approximately every other Thursday during the synchronous session, via Zoom breakout rooms. The remaining synchronous sessions will consist of problem sessions, informal discussion, or small group work.

The collaborative quizzes are designed to facilitate learning via interaction with your teammates, as the process of asking questions and explaining your reasoning enables knowledge synthesis. You will need to complete some preliminary work before the quiz, on your own, before coming together with your teammates to solve a series of increasingly complex questions related to an engineering design problem. Our research has shown that this approach improves regulation and monitoring of learning, and is associated with improved outcomes.

Graded work: Problem Sets and Collaborative Quizzes will be posted one week prior to their deadline. Every effort will be made to return graded work to students within one week. Most of the problem sets are due on Thursdays at the beginning of class. Most of the collaborative quizzes will occur on Thursdays.

Problem sets provide an opportunity for practice of the core course concepts. You are welcome to work on problem sets individually or together, but it is important to write up your solutions independently, in your own words, to solidify your understanding of the material.

Midterms and exams will be in the form of 24-hour take-home exams, but should only require as much time as a standard in-class exam to complete (e.g. 1:15 hours for each midterm, and 2 hours for the final).

4 Course Policies

4.1 Covid-19

The pandemic has created difficult circumstances for everyone. If you are experiencing hardship due to Covid-19 that makes keeping up with course deadlines difficult, please contact Dr. Oishi to discuss alternative arrangements.

UNM is committed to providing courses that are inclusive and accessible for all participants. Accessible classroom settings, in which students have full access and opportunity, are paramount.

If you are experiencing physical or academic barriers, or have concerns related to mental health, physical health and/or COVID-19, please contact Dr. Oishi. You are also encouraged to contact Accessibility Resource Center by email at arcsrvs@unm.edu or by phone at 277-3506.

4.2 Late or Missed Work

Midterms and Final: A passing grade on each exam is required to obtain a passing grade for the course. A missed midterm will result in a score of 0. Students who have a legitimate reason for missing a midterm, and communicate with Dr. Oishi *prior* to the midterm, may be able to arrange an alternative solution. Out of fairness to other students, Dr. Oishi cannot accommodate conflicts that are disclosed *after* the midterm is given.

Collaborative quizzes: Due to the fact that these quizzes occur during the synchronous session, make-ups are not possible. However, please note the lowest score will automatically be dropped.

Asynchronous quizzes: Perfect scores are required on all asynchronous quizzes in order to progress through each module. Quizzes can be completed as many times as necessary. Note that Learn unfortunately does not “remember” your prior attempts, so all answers must be re-submitted each time you take the quiz.

Problem sets:

Problem sets are due at the start of synchronous sessions. Late problem sets are not accepted without Dr. Oishi’s prior permission. Note that the lowest score will automatically be dropped.

Discussion questions: Late submissions to the discussion questions will not receive credit.

Academic Honesty: *Students are responsible for all academic integrity policies, including adhering to prescribed resources during exams and quizzes.* Please pay close attention to the restrictions for each assignment. For much of the course work, collaboration is encouraged. For problem sets, it is important that if you do collaborate with other students, that you write up your solutions in your own words. However, for the midterms and final exam, collaboration is not allowed, and discussion must be limited to that with Dr. Oishi and the TA.

4.3 Expectations for Student Conduct

Students are expected to participate fully in class discussion forums, and conduct themselves with courtesy and etiquette as would be appropriate for any non-online setting. Rudeness or disrespect will not be tolerated.

Written work (midterms, problem sets) must be legible and clear. Students are expected to practice good writing and organization.

Participation in the Microsoft Teams channels for discussion must adhere to appropriate etiquette: if you couldn’t say it in class, then please don’t post it here.

4.4 Getting Help and Asking Questions

Please ask questions! Students learn the most when figuring out what questions they have, formulating them, and finding the answers to them. This is not the same as asking, “How do you do solve this problem?” Better questions are, “I tried this and got stuck. I don’t see alternatives; can

you help?” or, “I don’t see how that follows, can you please explain?”

Course modules will incorporate active learning techniques that are designed to help students assess their own learning, and to facilitate learning via multiple learning styles. Collaborative learning will be employed as part of this. Working in groups can be helpful, because students can compare results, resolve inconsistencies, and be exposed to different approaches. Further, the act of explaining your reasoning to someone else deepens your own knowledge.

Students are always welcome to contact Dr. Oishi during office hours (either online or in person) with any questions or concerns, or to make an appointment to meet with Dr. Oishi. Please contact Dr. Oishi through UNM Learn (as opposed to directly through email). Dr. Oishi aims to respond to all messages within 24 hours.

4.5 How to Succeed in This Course

It is important to keep up with all deadlines. Due to the cumulative nature of the course material, it will be difficult to catch up after falling behind. If you anticipate conflicts that will make it difficult to stay up with the course, please talk to Dr. Oishi in advance, to come up with a plan to mitigate the effect.

If you have difficulty with a course concept, you have multiple options to seek help:

1. Go over the lecture notes, videos and examples in the modules, or recorded synchronous sessions, as appropriate.
2. Post a comment or question on the student discussion forum in Microsoft Teams, in the General channel.
3. Bring up your question during the synchronous session.
4. Talk with Dr. Oishi or the TA, Mr. Connor Halsey, during student drop-in hours.
5. Send Dr. Oishi a Course Message, anticipating an up to 24-hour turnaround in response time.

5 Equal Opportunity

5.1 American Disabilities Act

In accordance with University Policy 2310 and the American Disabilities Act, reasonable academic accommodations may be made for any qualified student who notifies the instructor of the need for an accommodation. The student is responsible for demonstrating the need for an academic adjustment by providing Student Services with complete and appropriate current documentation that establishes the disability, and the need for and appropriateness of the requested adjustment(s). However, students with disabilities are still required to adhere to all University policies, including policies concerning conduct and performance. Students who may require assistance in emergency evacuations should contact the instructor as to the most appropriate procedures to follow. Contact Accessibility Services at (505) 661-4692 for additional information.

5.2 Title IX

Our classroom and our university should always be spaces of mutual respect, kindness, and support, without fear of discrimination, harassment, or violence. Should you ever need assistance or have

concerns about incidents that violate this principle, please access the resources available to you on campus, such as through the LoboRESPECT Advocacy Center (<http://loborespect.unm.edu/>) and related support services. Please note that, because UNM faculty, TAs, and GAs are considered “responsible employees” by the Department of Education, any disclosure of gender discrimination (including sexual harassment, sexual misconduct, and sexual violence) made to a faculty member, TA, or GA must be reported by that faculty member, TA, or GA to the university’s Title IX coordinator. For more information on the campus policy regarding sexual misconduct, see <https://policy.unm.edu/university-policies/2000/2740.html>.